

**NATIONAL RENEWABLE ENERGY LABORATORY
ENVIRONMENTAL REPORT
FOR
2001**

Prepared by:
Environment, Safety & Health Office
National Renewable Energy Laboratory

NREL is a national laboratory of the
U.S. Department of Energy and is
operated by Midwest Research Institute, Battelle,
and Bechtel

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1. INTRODUCTION

The National Renewable Energy Laboratory (NREL) is a U.S. Department of Energy (DOE) national laboratory, and conducts research primarily for DOE's Office of Energy Efficiency and Renewable Energy (EERE). NREL is operated by the Midwest Research Institute, Battelle, and Bechtel under the oversight of the DOE Golden Field Office (GO). NREL is the nation's lead laboratory for developing and advancing renewable energy technologies and a primary laboratory for energy efficiency technologies.

1.1. Purpose

This report presents a summary of NREL's environmental protection programs and activities for 2001. It is organized according to the different environmental media (e.g. air, waste, ground water, etc.), and includes a brief summary of how the program is managed in that area, any permitting or notification efforts that have been completed during the reporting period or are ongoing, and activities that have occurred during the reporting period in that environmental area. A description of the environmental condition and features of NREL's sites is also included to provide a basis for the program overview.

1.2. Background

NREL's mission: NREL develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals.

NREL fulfills its mission through technology portfolios; a brief description of each major technology area follows.

Photovoltaics: Photovoltaics is the direct conversion of sunlight to electricity using solid-state materials. The National Center for Photovoltaics develops and deploys photovoltaic (PV) technology for the generation of electric power.

Wind Energy: Through the National Wind Technology Center, NREL develops, improves, and demonstrates the viability of wind technology for electricity generation and facilitates its deployment throughout the world

Bioenergy: NREL currently has major programs in both biomass-derived fuels (biofuels) and biomass-derived electricity (biopower), and projects in biomass-derived chemicals and materials.

Renewable Thermal Technologies: These technologies generate power from heat or utilize heat from renewable resources. They include concentrating solar power, solar water heating, and geothermal heat and power.

Distributed Power: Distributed power is modular electric generation or storage located near the point of use. NREL participates in the development of

technologies, market structures, and policies that affect the incorporation of renewables and energy efficiency technologies in distributed power systems, maximizing the deployment of renewable energy and energy efficiency products. As a part of this initiative, NREL is involved in the development, design, and deployment facilitation of renewable and renewable/fossil hybrid distributed power systems in grid-connected applications.

Building Energy: NREL increases the use of energy efficiency technologies and expands the use of renewable energy technologies in the building sector by working to develop new, cost-effective, and environmentally acceptable building equipment and envelope systems.

Hydrogen: NREL serves as a leader in renewable hydrogen production technologies as well as in advanced storage and sensor development. Basic and applied research and material development using biology, physics, and chemistry enable and support the development of hydrogen production, storage, and end-use systems.

Advanced Vehicles: NREL works with industry to develop advanced vehicles and systems for transportation, and to develop viable vehicle systems that are integral to DOE transportation initiatives.

Advanced Fuels: NREL works with energy companies and manufacturers of vehicles and engines to develop advanced motor vehicle fuels for improved energy and environmental performance. A systems approach is used to develop optimized engine management, fuel, and emission control technologies.

Basic Science: The basic science that underlies NREL's technologies is currently focused on materials growth and analysis for photovoltaics and related technologies; solid-state theory and characterization; superconductivity; advanced materials and concepts such as semiconductors and metals; photoconversion, which is using innovative approaches to converting solar photons to fuels, chemicals, and electricity; electrochemistry as applied to fuel cells, solar hydrogen production, advanced batteries, and electrochromic devices; catalyst design that includes converting carbon dioxide to fuels and products; and microbiology and biochemistry applied to converting biomass into energy and products.

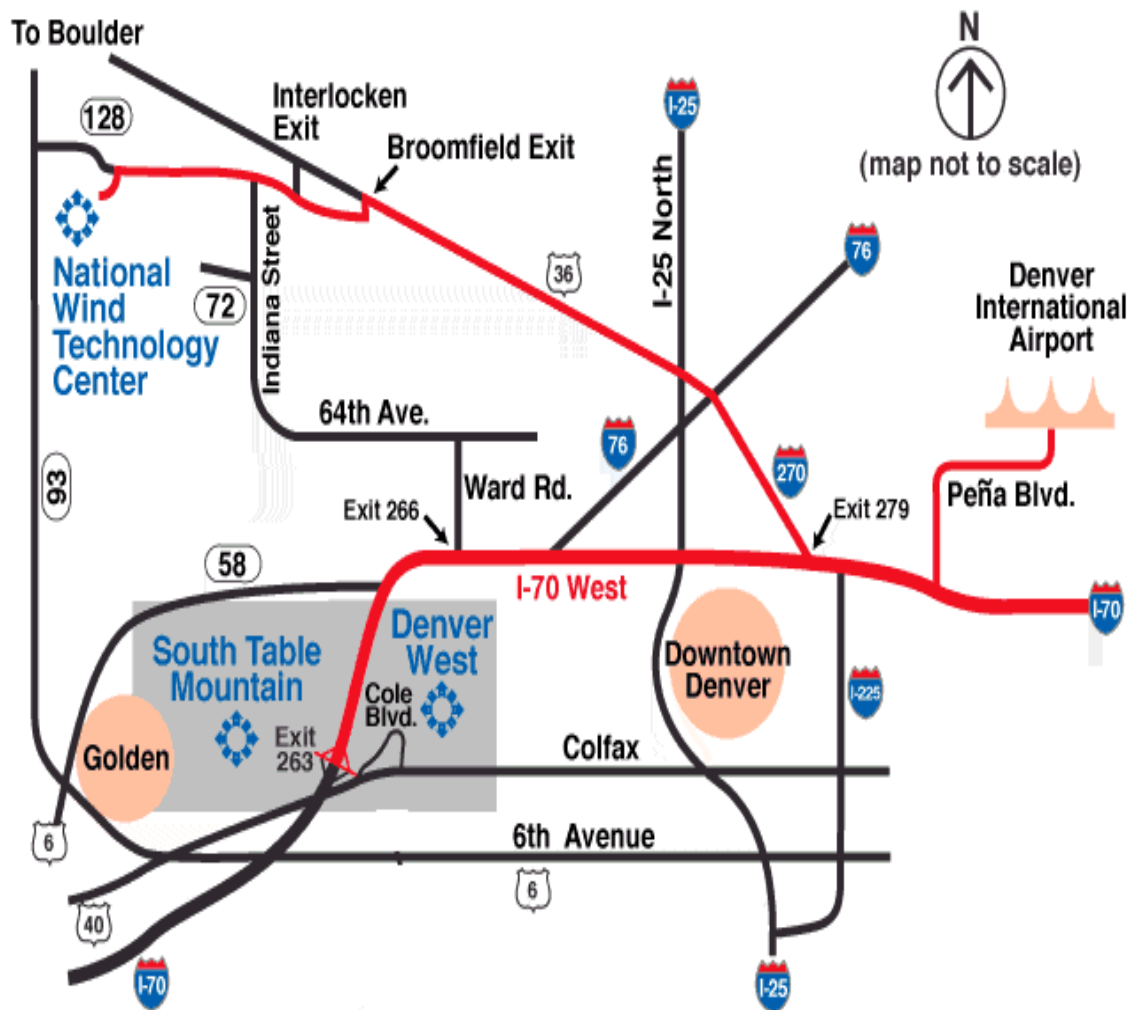
1.3. Site and Facility Description

NREL facilities occupy four separate locations in Jefferson County, Colorado, near the city of Denver. The four facilities are the Denver West Office Park (DWOP), the South Table Mountain site (STM), the Joyce Street Facility (JSF), and the National Wind Technology Center (NWTC). The DWOP and STM sites are approximately 2 miles (3.2 km) east of Golden and 12 miles (19.3 km) west of central Denver. The NWTC is located near the intersection of Highways 93 and 128, between Boulder and Golden, and is approximately 15 miles (24.2 km) north of the STM site. It is adjacent to the DOE Rocky Flats Environmental

Technology Site. The JSF is located at 6800 Joyce Street, approximately 5.5 miles (8.9 km) north of the DWOP and STM sites. Figure 1.1 illustrates the locations of all of the sites, except the JSF site on a regional map. Figure 1.2 provides a more detailed map of the STM site, and Figure 1.3 gives a more detailed map of the NWTC site.

The STM and NWTC sites are the two main sites where research operations are conducted. These two sites will be addressed separately in the discussion of environmental features. The DWOP is leased space used primarily for administrative functions and limited research activities. The JSF is also a leased space that is used for storage.

Figure 1.1 – Regional Map



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Figure 1.2 – STM Site Detail

HERE

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Figure 1.3 – NWTC Site Detail

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2. SITE ENVIRONMENTAL CONDITIONS/FEATURES

Photos for each site documenting the site features and development, as they existed during 2000 and 2001, are included at the end of this section. Figures 2.1, 2.2, 2.3 and 2.4 illustrate the South Table Mountain site, and Figures 2.5 and 2.6 illustrate the National Wind Technology Center site. The views on the STM site also illustrate the Conservation Easement property and the Camp George West property acquired in 1999.

2.1. South Table Mountain Site

Geology, Soils, and Hydrogeology

The STM site is a roughly triangular parcel of land occupying portions of the top, sides, and lower south-facing slopes of South Table Mountain. South Table Mountain is composed of sedimentary rocks below a basalt lava cap, which is quite resistant to erosion. The South Table Mountain feature is a mesa that stands about 150 meters above the adjacent lowlands. It was formed by the erosion of weak sedimentary rocks surrounding the mesa's erosion resistant lava cap. Below the lava caprock, the sedimentary rocks are part of the Denver Formation that consists of layers and lenses of claystone, sandstone, and conglomerate. Sedimentary rocks of the Arapahoe Formation underlie the Denver Formation.

Both the Arapahoe and Denver Formations are considered to be aquifers in portions of the Denver Basin. The Denver Formation underlies the areas on which most NREL construction has taken place. Groundwater on the STM site occurs primarily in the weathered and fractured silts and sands of the Denver Formation. There may also be some groundwater in the form of perched aquifers below the basaltic lava cap on the South Table Mountain and within the materials above the Denver Formation, which are largely the result of stream deposits. Groundwater flow on the site is in a southeasterly direction.

The soil covering the top of South Table Mountain is Lavina Loam. A loam is composed of a mixture of clay, sand, silt, and organic matter. The loam on the mesa top is a shallow, well-drained clayey soil. Soil on the upper side slopes of South Table Mountain is also a loam consisting of extremely stony soils with significant amounts of clay. Much of the remainder of the site, including the area designated for major development, has a deep, well-drained soil referred to as Denver clay loam. It consists of clayey material containing some calcium carbonate. There are also two smaller soil areas on the southwestern portion of the site, both of similar character to other site soils: cobbly clay loam and very stony clay loam.

Surface Water

About 90% of the surface drainage off the site, both the mesa top and across the lower portions of the site, is in the southerly direction toward Lena Gulch (a tributary of Clear Creek). Two drainageways on the easternmost portion of the site are intercepted by Welch Ditch, which ultimately flows into Lena Gulch.

There is no permanent stream flow on the STM site. Only occasional flow derived from extended periods of precipitation, usually during the late winter and early spring, is found in the drainage channels with seasonal springs evident along some of the mesa slopes. There is one seep on the mesa top that is active throughout most of the year, but the water infiltrates and evaporates quickly during dry times of the year.

Vegetation

Two primary vegetation types are present on the STM site: grasslands and shrublands. The most common plant communities on the STM site are mixed grasslands, comprising over 80% of the vegetation on the site. These communities are generally dominated by short- and mid-grass species. Two primary upland shrub communities occur on the STM site: mountain mahogany shrublands, found on the shallow soils of the mesa, and upland shrublands, occurring in drainages lacking active channels as well as drainages with associated wetlands. Recent field surveys have identified limited wetland/riparian areas along drainages. The wetland communities identified on the STM site are a very minor component of the total vegetation cover, accounting for less than 1% of the vegetation over an area of less than 0.3 ha (0.75 ac). Riparian shrub communities also occur adjacent to the emergent wetlands.

Wildlife

A wildlife survey was conducted on the site during 1986 and 1987, and additional surveys were done in 1999 over the Conservation easement property. Mammals seen using the site during the survey were the mule deer, coyote, grey fox, red fox, raccoon, longtailed weasel, striped skunk, spotted skunk, badger, bobcat, mountain lion, rabbits, and yellow-bellied marmots. Seventeen species of birds were observed on the STM site, along with two species of raptors: kestrels and two nesting pairs of red-tailed hawks. NREL personnel have reported numerous sightings of snakes as well as a golden eagle. A variety of amphibian species are expected to inhabit the area.

Land Use

The STM site is a 325-acre area predominantly bordered by open grassland zoned for recreation and light-commercial activity. Portions of the community of Pleasant View are located immediately to the south and west of the western portions of the STM site. Pleasant View is currently planning a recreational park immediately south of the STM site. Offices, shops, and a tree nursery owned by the Colorado State Forest Service are located at the far western edge. Undeveloped state land and a Colorado State Highway Patrol pursuit driver training track are located along the northwestern boundary of the STM site. Jefferson County open space wraps around the northern and the eastern edge of the site. Portions of the DWOP and apartment homes lie to the east.

More than half of the STM site (177 acres) has been set aside in a Conservation Easement. No development is allowed on that land, with the exception of some

existing utility easements and recreational trails to be established by Jefferson County Open Space.

2.2. National Wind Technology Center

Geology, Soils, and Hydrogeology

The NWTC site is located on a plain formed by stream deposits. The uppermost geological layer beneath the site is known as the Rocky Flats Alluvium (RFA). It is composed of cobbles, coarse gravel, sand, and gravelly clay. Below the RFA are the Laramie Formation, Fox Hills Sandstone, and Pierre Shale. These rock formations consist primarily of claystones with some siltstones. Unconfined groundwater flow occurs in the RFA toward the east/southeast, and small perched zones are common. Groundwater occurs as confined aquifers in the deeper bedrock formations (EG&G Rocky Flats, Inc., 1992).

The NWTC has a strongly developed soil defined as a very cobbly, sandy loam. The soil is characterized by a large amount of cobble and gravel in the soil volume, and a subsoil dominated by clay (USDA, 1995).

Surface Water

The area surrounding the NWTC site is drained by five streams: Rock Creek, North Walnut Creek, South Walnut Creek, Woman Creek, and Coal Creek. Rock Creek flows eastward and is located southeast of the NWTC. North Walnut Creek and South Walnut Creek flow eastward into the Great Western Reservoir. Woman Creek drains eastward into Standley Lake. Coal Creek flows in a northeasterly direction across the City of Boulder open space north of the NWTC.

The majority of the NWTC drains into a tributary to Rock Creek. Some of the northern portions of the site drain into Coal Creek or its tributaries.

Vegetation

The NWTC is located in the transition area between the Great Plains and the Rocky Mountains (Plantae Consulting Services, 2000). This location results in a flora that contains elements from both mountain and prairie ecosystems and associations that represent residual tall grass prairie, short-grass plains, ponderosa pine woodland, and foothill ravine flora (Plantae Consulting Service, 2000).

A vegetation study conducted between August 1999 and August 2000 identified 271 vascular plant species and defined five major habitat types on the NWTC site including the following: Seasonal wetlands/or ephemeral hydric soils, woodlands, shrublands, mixed grasslands, and disturbed areas.

Along the Northwestern ridge is a Ponderosa pine woodland area. Vegetation found in this area includes woody species with an understory of grasses, forbs, and shrubs.

Wildlife

Prior to 1975, the NWTC site was heavily grazed by livestock, damaging a majority of the native vegetation. A wildlife survey was conducted in 1992 for the entire Rocky Flats Plant and buffer zone area, including the NWTC site. Signs or tracks of bears and mountain lions were identified. Other mammals known to feed at the site are mule deer, coyotes, desert cottontail rabbits, white-tailed jackrabbits, black-tailed jackrabbits, deer mice, prairie voles, and thirteen-lined ground squirrels. Approximately 20 different species of birds were sighted at or near the site. Raptor (birds of prey) surveys were conducted at the NWTC in 1994 and 1995, and identified seven raptor species on or in the vicinity of the site.

Land Use

The NWTC facility occupies a 305-acre area surrounded by open grazing land, with the exception of operations at the Rocky Flats Environmental Technology Site, which borders the NWTC to the southeast, and a sand and gravel mining operation along the southern and western boundaries of the site. A blasting company also has a small installation along the western site boundary.

A piece of land of about 25 acres, located at the southeast corner of the NWTC, was recently designated for inclusion within the NWTC by the National Defense Authorization Act (see Figure 1.3). Two test sites and unimproved roads are located on this land. The transfer of this land parcel from DOE Rocky Flats should be completed later in 2002.

2.3. Denver West Office Park

The DWOP is a relatively flat, landscaped office complex occupied by a number of four-story buildings, parking lots, and common areas. NREL-leased facilities at DWOP are located approximately in the geographic center of the development. The DWOP is bordered on the south by commercial areas (West Colfax strip); on the west by the Pleasant View residential area, Camp George West facility, and the STM site. DWOP is within the City of Lakewood.

2.4. Joyce Street Facility

The JSF is located in a commercial area surrounded by agricultural land, residential neighborhoods, and small businesses. It is currently used by NREL as warehouse space only. No research or support activities are conducted at the facility, and there are no staff offices at JSF.

2.5. Meteorology

The climate for the geographic region of NREL operations is classified as semi-arid, typified by sparse precipitation, low relative humidity, abundant sunshine, and large daily and seasonal temperature variations.

The area experiences moderate precipitation, with average annual rainfall less than 50 cm (20 in). Almost half of the annual precipitation occurs from March to June. Summer showers contribute 33% of the annual precipitation total. Precipitation begins to decrease significantly in the fall, and reaches the minimum during winter. Winter is the driest season, contributing less than 10% of the annual precipitation, primarily in the form of snowfall.

Spring is a season of unstable air masses with strong winds along the foothills and the Front Range. The highest average snowfall occurs in March, and the STM site can generally expect to experience at least one heavy snowstorm with totals exceeding 15 to 25 cm (6 to 10 in.).

The solar radiation (sunlight energy) of the region is excellent for outdoor research and testing of solar energy conversion devices and systems. Sunshine is abundant throughout the year and remarkably consistent from month to month and season to season.



Figure 2.1 – STM Site – Aerial view looking north, showing facilities and Conservation Easement lands.



Figure 2.2 – STM Site – View looking northwest, showing Camp George West acreage acquired in 1999 and portions of the Pleasant View neighborhood.



Figure 2.3 – STM Site – View looking east.



Figure 2.4 – STM Site – View looking southeast, showing portions of Pleasant View and Denver West Office Park.



Figure 2.5 – NWTC – View looking northwest



Figure 2.6 – NWTC – NW View with Turbine

3. ENVIRONMENTAL PROGRAMS

The objective of NREL's environmental management program is responsible stewardship of the environment, both on its DOE-owned sites and leased properties. NREL strives to protect the natural environment by minimizing or eliminating any adverse environmental impacts resulting from NREL activities. The Laboratory's environmental management program is integrated throughout all research and operations Centers and Offices. The program includes written environmental protection policy and program implementation documents. These are put into practice at all staff and management levels.

NREL's environmental management program includes components to address waste, air, water, natural resources, and land and soil issues, among others. Descriptions of the components of the environmental management program are provided in the following sections of this chapter. Sections are organized by resource. Each section is comprised of three areas of discussion: a summary of the environmental management of the resource, a discussion of any relevant permitting, and finally a summary of significant activities that have occurred throughout the year.

A summary of the permits and notifications that have been issued by regulatory agencies for NREL activities is presented in Appendix B. These permits are discussed in the relevant sections below.

3.1. Air Quality Protection

3.1.1. Program Management

Management in this area is consistent with the following NREL programs: Environmental Permitting and Notification (6-2.1), Air Quality Protection (6-2.5), Ozone-Depleting Substances Management (6-2.6), and Particulate Emissions Control for Construction (6-2.14).

Criteria, Hazardous, and Non-Criteria Pollutants

The Clean Air Act and State of Colorado laws and regulations delineate several main categories for air pollutants:

- Criteria air pollutants (e.g. carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter, ozone, and lead)
- Hazardous air pollutants (e.g. includes organic compounds, metals, corrosives, asbestos, radionuclides, and pesticides)
- Non-criteria pollutants (e.g. ammonia, hydrogen sulfide, pesticides, organic compounds, metallic compounds, corrosives, and ozone-depleting substances)
- Ozone depleting substances (e.g. chlorofluorocarbons or "freons")

There are notification and permitting thresholds for criteria, hazardous, and non-criteria pollutants. Potential sources of these pollutants at NREL include boilers, emergency generators, experimental laboratory hoods, pilot scale research projects, and small pieces of equipment with gasoline or diesel engines. NREL maintains air emission inventories to track potential air emissions and identify

whether notification and permitting could be required for a particular facility or activity. Fugitive particulate emissions from construction activities occurring on NREL's sites are also a potential source.

Ozone Depleting Substances

Facilities that service refrigeration equipment containing ozone-depleting substances (ODSs) are required to file an annual notification with the Colorado Department of Public Health and Environment (CDPHE). This equipment servicing must be conducted by EPA-certified technicians, and NREL has certified technicians on staff that perform this type of service.

Another requirement of the State of Colorado's ODS program is that all refrigeration equipment larger than 100 hp that uses ODSs be registered with CDPHE. NREL has two chillers at its Solar Energy Research Facility (SERF) that are registered with CDPHE.

Street Sanding

CDPHE regulations require federal, state, and local government facilities to track wintertime street sanding, and to make efforts to minimize sand use. NREL complies with this requirement and files an annual sanding report with CDPHE. During the period of December 2000 to April 2001 NREL used 30 tons of sand during 11 sanding episodes. During the period of November 2001 to March 2002, NREL used 17 tons of sand during 9 sanding episodes. NREL maintains 4 lane-miles of roads.

Vehicles

NREL leases 48 vehicles from the General Services Administration. These vehicles are used for a variety of transportation and special purpose activities, such as equipment moving and servicing, grounds maintenance, and travel between the NREL sites. Thirty-four of the vehicles are classified as Non-Special Purpose and are used as personal transportation only. Twenty three of these Non-Special Purpose vehicles are alternate-fuel vehicles, utilizing ethanol, diesel, or compressed natural gas (CNG). It is NREL policy to replace standard vehicles with alternative fuel vehicles whenever possible. The remainder of the vehicles are classified as special purpose and include vehicles such as delivery trucks, dump trucks, and pickup trucks. Two of the special-purpose vehicles are electric and the remainder of the vehicles are not available with alternative fuel options.

3.1.2. Permitting

Most potential sources of air emissions from NREL laboratory and facility operations in 2001 were small scale and did not require permitting. Permitting thresholds are generally 50, 500, 1000, or 2000 pounds, depending on the pollutant. Projected emissions for these sources were either below thresholds for air permitting or the state reviewed the operation and determined emissions to be negligible in terms of impacts to the environment.

Two Air Pollutant Emissions Notices (APEN) and permit applications were filed with CDPHE in 2000 for the renewal of site wide permits covering particulate emissions from construction areas. One permit covers the STM site, and the other is in effect for the NWTC. These permits were received in March 2000.

3.1.3. 2001 Activities

No APENS were filed in 2001.

Final permitting approval was obtained in April 2002 for the proposed scale-up of the experimental pilot scale Thermochemical Process Development Unit (TCPDU), located at the Field Test Laboratory Building (the APEN was filed in 1999).

3.2. Drinking Water

3.2.1. Program Management

Management in this area is consistent with the following NREL Programs: Drinking Water (6-2.3) and Environmental Permitting and Notification (6-2.1).

Drinking water is provided to NREL's STM and DWOP sites by a public water supply, Consolidated Mutual Water Company. Water to the JSF is also provided by a public water supply. NREL supplies drinking water to its NWTC by trucking in water from the Boulder public water supply through a subcontracted water hauler. NREL stores the water on site in an underground 15,000 gallon storage tank and an above ground 2000 gallon tank. The 15,000 gallon tank is filled by the water hauler, and water is pumped on demand to the 2000 gallon tank, where it is distributed to the Industrial User Facility (IUF) and Building 251.

Disinfection boosting is performed at the NWTC using a chlorine disinfection system, which was installed in June of 2000. An ultraviolet lamp system previously used for disinfection boosting was removed in November 2000.

Testing for bacteria, lead, and copper is performed at the NWTC according to the requirements of CDPHE. In 2000, NREL filed an application requesting reduced monitoring for lead and copper, because historical monitoring results have consistently been below action thresholds established by the State. NREL subsequently received notice of qualification from the State for reduced monitoring. Current state requirements for NREL's site are as follows:

- Bacteria – monthly
- Lead and copper – triennially
- Chlorine residual – monthly, or more frequently as needed

All samples are taken from one of the taps connected to the system. Bacteria were present in one sample collected in the IUF in October 2001 for total

coliform. Following the receipt of these results, a total of five follow-up total coliform samples were taken from the IUF, Building 251 and the Pump House in October 2001. Total coliform was absent in all of the five follow-up samples collected. Follow-up sampling was repeated again in November 2001, and total coliform was absent from all five samples collected at that time.

Although lead and copper monitoring was not required in 2001, as a best management practice, samples were collected from Building 251 and the IUF in September 2001 for both metals. Results were well below the action levels. According to NREL's triennial schedule, monitoring for lead and copper will be conducted again during the summer of 2002.

Chlorine residual monitoring of the NWTC drinking water system began with the installation of the chlorine disinfection system in 2000. Monitoring is performed to ensure the chlorine residual levels are detectable, with a target concentration of at least 0.2 mg/L of chlorine present to provide sufficient disinfection at the taps for both Building 251 and the IUF. The state requires that chlorine residual monitoring occur when collecting bacterial samples (monthly). NREL monitors chlorine residual levels in the system on a weekly basis and also measures chlorine levels of drinking water that is delivered to the NWTC. Monitoring results have shown the concentration of residual chlorine to be detectable since the chlorine disinfection system became operational.

Although potable water delivered to the NWTC is from the Boulder supply that has already been treated and filtered, drinking water at the NWTC is filtered on site using a 1 micron filter. This would filter out any microorganisms (e.g. cryptosporidium or giardia) that are resistant to disinfection. The filters used by NREL are third-party tested to confirm that they actually filter particles as small as 1 micron in size.

If any treatment is performed on supplied drinking water, state regulation requires that a State-licensed operator supervise the treatment. NREL hires a subcontracted operator with a Class A license to supervise the disinfection and filtration operations and to perform the necessary sampling.

3.2.2. Permitting

NREL has a Public Water Supply Identification Number (PWSID) issued by CDPHE for the drinking water it provides at the NWTC. This identification number does not require periodic renewal, but periodic testing and record keeping is required in connection with the PWSID. No identification is needed for NREL's STM, DWOP, or JSF sites, as water is piped from another PWSID, Consolidated Mutual Water Company, and NREL does not alter or treat the water in any way.

3.2.3. 2001 Activities

An Operator in Responsible Charge report was filed with the State in 2001, as required. This report identifies NREL's licensed operator. It will be kept current in the event NREL's operator changes.

In November of 2001 drinking water monitoring was performed in the FTLB, on the STM site, in response to building occupant concerns regarding the poor taste of the water. This monitoring involved collection of samples from multiple water outlets for turbidity, residual chlorine, total organic carbon, total coliform, nitrite, nitrate, sulfate, and 6 metals including chromium, copper, iron, nickel, lead and zinc. The monitoring results did not point to a source of the poor water taste, but revealed elevated levels of lead and turbidity at one of the drinking fountains. Extensive follow-up drinking water monitoring was performed for lead throughout the FTLB, which revealed that lead contamination was isolated to a few water outlets within the building. In those locations, the lead sources appeared to be within the outlets or the lateral piping leading to the outlets. Filters that remove lead were placed on the outlets that are used for drinking water and tested positive for lead. The remaining outlets testing positive for lead have restricted access and are not intended for drinking water purposes (i.e. custodial sinks); they were posted with signs prohibiting their use for drinking water purposes. Additional follow-up monitoring will be performed in late 2002 when the lead filters are due for replacement.

3.3. Ground Water Protection

3.3.1. Program Management

Management in this area is consistent with NREL's Groundwater Protection Program (6-2.4).

Because of the sensitive nature of the ground water resource, NREL is careful to evaluate all outdoor projects to attempt to eliminate their potential to impact ground water quality. If there are any materials used that could pose a potential ground water risk, the Laboratory typically insists that safeguards to protect ground water be established, such as secondary containment for equipment that could have the potential to leak oil, double wall tanks with leak detection for diesel fuel storage for NREL facilities' emergency generators, and bermed areas to contain experimental materials.

Ground water characterization was begun on the STM site in 1990 with the installation of a monitoring well network. Eight wells were installed at the base of the mesa slope. Four wells were installed upgradient of NREL development in order to provide an indicator that contaminants were not being transported onto the NREL site, and four wells were placed in a generally downgradient direction to verify that NREL activities had not adversely affected ground water quality. Quarterly sampling was performed for five calendar quarters, followed by annual sampling for three years. There was no evidence of contamination

found. In addition, routine follow-up sampling was done in 1997. Three of the initial eight wells were closed (according to state requirements) due to construction activities in 1993, and a fourth was found to be inaccessible during the 1997 sampling, presumably also due to construction activity in the area. Therefore follow-up samples were only collected from four of the original monitoring wells: three upgradient wells and one downgradient of NREL development. No evidence of contamination was found in the 1997 sampling.

NREL has not conducted groundwater monitoring at its leased DWOP site, as there have been no activities that pose an unusual risk to groundwater quality. If NREL had reason to suspect a groundwater quality problem, the issue would be addressed with Denver West Management. DWOP management contracted with an engineering firm to conduct a cursory groundwater monitoring study in 1988 adjacent to the NREL-leased buildings. Two monitoring wells were drilled. There were no detections of significant levels of contaminants.

The NWTC currently has no open or active groundwater wells. There was a water supply well that provided water to Building 251 when the site was operated by DOE's Rocky Flats Office. In 1993, NREL collected one round of water samples from this well and the associated water distribution and treatment system for the purpose of determining the most feasible alternative for water supply to the site. Based on the sampling results, it was determined that the maintenance and repairs required to make the existing well and treatment system effective were extensive, and there was an indication of the potential for trace organic compounds in the water. Therefore, when DOE's Golden Field Office assumed landlord responsibility for the site in 1993, the connection between the building and the well was severed. The water supply well was plugged and abandoned in accordance with state regulations by an NREL subcontractor in 1996. Potable water is currently transported to the site, as described in Section 3.2. NREL has not done any other groundwater sampling at the site. Groundwater sampling will be conducted if future activities pose a risk to the groundwater quality.

There has been no ground water study performed by NREL at the JSF, as NREL has not conducted any activities at the site that pose an unusual risk to ground water. All activities at the site are conducted inside the facility with the exception of routine deliveries and pick-up of inventory stored in the warehouse.

There is currently no ongoing routine ground water monitoring program on any NREL site, because, with one exception, there have been no activities identified that currently or historically posed a significant risk to ground water. The one occurrence that had the potential to impact ground water was a diesel leak to the environment in June 1998 from a failed check valve on the PDU emergency generator above ground storage tank at the Alternative Fuels User Facility. The majority of contaminated soil was excavated and removed from the site for disposal at a permitted landfill. Three ground water monitoring wells were installed at the site in September 1998, one upgradient, and two downgradient. No hydrocarbon contamination was detected in the ground water during the

initial sampling of the three wells, nor during follow-up sampling conducted in March and September 1999, and March 2000. Based on the results of these follow-up samples no further samples will be collected.

3.3.2. Permitting

All ground water monitoring wells installed by NREL at the STM site have been permitted with the Colorado Department of Natural Resources. Abandonment paperwork has also been filed with the State of Colorado for the three wells that were plugged in 1993.

3.3.3. 2001 Activities

Plans are being developed to close the three monitoring wells installed in September 1998.

3.4. Wastewater Discharge

3.4.1. Program Management

Management in this area is consistent with NREL's Waste Management and Minimization Program (6-2.8).

The majority of wastewater from NREL's STM and DWOP facilities flows into the Pleasant View Water and Sanitation District's system and ultimately to Metro Wastewater Reclamation District's (Metro) treatment plant. There is a small septic system consisting of a tank and absorption field, on the mesa top serving the Solar Radiation Research Laboratory (SRRL), because there is no sewer line to the mesa top. Wastewater from the JSF flows into the City of Arvada's collection system where it is also routed to Metro's treatment plant. The NWTC is not connected to a sewer system, but has two septic systems that include tanks and absorption fields for the treatment of wastewater.

It is NREL policy that hazardous chemicals are not to be discharged to the sewer system, and NREL staff are trained in this policy. In addition, NREL sites have design criteria for waste drains in lab areas to minimize the possibility of a hazardous material discharge. These criteria include measures such as secondary containment for any chemicals used near sinks in laboratory exhaust hoods, no floor drains in laboratory areas unless a specific need can be shown, and caps for any floor drains that are installed in lab areas. New research and operations activities as well as ongoing activities that undergo significant modifications are reviewed for their potential effect on wastewater character through NREL's risk assessment process.

Quarterly wastewater monitoring at the DWOP leased facilities and at the STM site was initiated in mid-1992 and continued throughout 1994 to demonstrate that NREL facilities' wastewater effluent met local publicly owned treatment works, state, and EPA standards. Both 24-hour composite and grab samples were

collected and demonstrated that discharges from Building 16 in the DWOP and the FTLB met all applicable regulatory standards.

Manual grab sampling was also performed at the Building 15 photography laboratory wastewater sump with the same frequency as the other sampling during 1992 and 1993. The sump was decommissioned in 1994, and direct sampling of photo lab wastewater streams was conducted throughout 1994 to verify that standards were met.

3.4.2. Permitting

No permitting for the majority of NREL's wastewater discharges is required. NREL has no direct wastewater discharges to the environment at the DWOP or JSF, so no National Permit Discharge Elimination System (NPDES) permitting is necessary. The only discharges at the STM and NWTC sites are through three individual sewage disposal systems, two at the NWTC and one at the STM site. The remainder of NREL facility wastewater is discharged to Metro through the sanitary sewer system. NREL facilities are currently classified as non-industrial water users at these sites because they discharge less than 97,633 L (25,000 gal) per day from each connection to the sewer system, and their effluent does not contain any toxic pollutants. As non-industrial users, NREL sites do not need a permit from Metro for sewer discharge, and monitoring for pollutants in wastewater is not required.

NREL maintains septic permits from Jefferson County (an authority delegated to the counties under a State of Colorado program) for the NWTC septic systems as well as for the SRRL facility on the STM site mesa top.

3.4.3. 2001 Activities

In maintaining a septic permit for the SRRL, in February 2001 the Jefferson County Department of Health and Environment requested information regarding the volume of water discharged to the septic/leach system at the SRRL. NREL submitted a written report to the County, which detailed the total monthly water usage and estimated the daily water usage at the SRRL. The system was determined to be in compliance with its permitted capacity. The County requested that NREL continue to monitor the water usage at the SRRL until June 2002 to verify the water usage stays within the limits of the septic system permit.

3.5. Surface Water Protection (Storm Water)

3.5.1. Program Management

Management in this area is consistent with the following NREL Programs: Storm Water Pollution Prevention for Construction Activities at the STM, and Storm Water Pollution Prevention for Construction Activities at the NWTC (6-2.15 and 6-2.16, respectively)

Limited storm water monitoring was conducted at the STM site during the summers of 1992 and 1993 to characterize surface water quality at NREL's existing level of activity at that time, and to confirm that NREL's activities were not adversely impacting storm water quality on the STM site. Sampling indicated that NREL's activities are not resulting in contamination of storm water runoff.

No storm water monitoring has been conducted at NREL's other sites. In 1998, surface water samples were taken in two drainages at the NWTC in connection with NREL's weed control efforts. No traces of the herbicide applied to weed-infested areas were detected in the water samples.

Outdoor research projects are reviewed during the planning stages, through NREL's risk assessment program, for potential impacts to surface water. Measures to prevent such impacts are incorporated, as appropriate, into the design for each project. Such control measures could include secondary containment and bermed areas where chemicals will be used, or installation of a cover or roof to protect chemical use and storage areas from precipitation and adverse weather conditions.

Storm Water Pollution Prevention Plans (SPPP) have been written for construction activities on both the STM and NWTC (6-2.15 and 6-2.16, respectively). Erosion and sediment controls are implemented according to the plans, and periodic site inspections are conducted to verify that the controls are functioning properly and to identify any repairs to the erosion and sediment controls that are needed. Written reports are issued for each inspection, with corrective actions assigned to responsible staff when necessary. The SPPPs also provide for prompt revegetation of disturbed areas. Provisions of the SPPPs are implemented through coordination with NREL's construction subcontractors.

3.5.2. Permitting

NPDES permitting for storm water discharges on federal facilities in Colorado is under the jurisdiction of the Environmental Protection Agency (EPA). NREL is currently covered under EPA's general permit for storm water discharge associated with construction activities on the STM and NWTC sites. Both Midwest Research Institute, as operator, and DOE, as site owner, have been issued permits. EPA has issued separate permit numbers for each owner and operator at each site for a total of four permit numbers. No permits are required for NREL's routine operations.

3.5.3. 2001 Activities

In 2001 there were a few research-related and paving construction projects for which erosion and sediment control programs were developed. These were minor in terms of the extent of soil disturbance. There were no major construction projects in 2001.

3.6. Waste Management

3.6.1. Program Management

Management in this area is consistent with the following NREL Programs: Waste Management and Minimization (6-2.8), and Environmental Permitting and Notification (6-2.1).

Hazardous wastes are handled and disposed according to the Resource Conservation and Recovery Act (RCRA). NREL facilities' waste profile consists of a broad range of hazardous laboratory chemicals in small quantities. Chemicals in solid or liquid form are collected in each laboratory or at each experimental site. These wastes are periodically collected from the laboratories and prepared by the NREL ES&H Office for off-site disposal.

It is NREL's policy to have the majority of its RCRA-regulated wastes incinerated, rather than landfilled, in order to more completely destroy the hazardous constituents and minimize any potential for future public exposure. This treatment and disposal is conducted at an EPA-permitted treatment, storage, and disposal facility. In addition, NREL facilities have adopted a conservative waste disposal policy in which materials that are not regulated by RCRA, yet pose a potential hazard, are collected and disposed of as non-hazardous material at a RCRA-permitted disposal facility.

NREL facilities also generate a very small amount of low level radioactive waste. The average amount of radioactive waste generated is typically less than 1 cubic meter (about 10 to 20 kg) per year, including packing material. This waste normally consists of personal protective equipment such as gloves and water-based liquids. Radioactive waste is shipped off-site for disposal on an as-needed basis.

As a facility that focuses on renewable technologies, NREL is committed to responsible environmental stewardship. A significant part of this effort is pollution prevention. NREL's Waste Management and Minimization Program outlines pollution prevention principles that are consistent with the EPA's hierarchy of preventing or reducing pollution at the source; recycling or reusing waste materials that cannot be prevented; and environmentally safe treatment and disposal of waste that cannot be prevented, recycled, or reused.

The current pollution prevention program includes training on waste handling, waste minimization, and methods to eliminate releases to air, soil, or wastewater. In addition, the Environment, Safety and Health Office (ES&H) integrates pollution prevention awareness into NREL activities in a number of ways. The proposed use of chemicals in projects are evaluated prior to use during project planning reviews, Safe Operating Procedure reviews, and Readiness Verifications conducted according to NREL's Hazard Identification and Control Program (ESH 6-6.2). During these reviews, NREL staff evaluate opportunities

for chemical substitution as well as methods of reducing the volume of chemicals used and waste streams generated.

The use of bankcards for chemical purchases has been another means of reducing the volume of chemicals purchased, stored and disposed at NREL. Under the chemical bankcard purchasing system, a small group of chemical users are given privileges to order chemicals directly from the vendor using their bankcards. Because bankcard purchasing expedites chemical purchases over conventional purchasing processes at NREL, users order only the chemicals they foresee they'll need in the immediate future, knowing that they can quickly obtain more if needed. The ES&H Office reviews all purchases made using the chemical bankcards.

Recycling and reuse activities are important components of NREL's pollution prevention program. NREL currently has a volunteer Recycling Committee that has greatly contributed to expanding NREL's recycling efforts. Items currently recycled or reused at NREL include the following:

- fluorescent bulbs
- waste oil containing no hazardous contaminants
- batteries
- styrofoam peanuts and other packing materials
- freon from refrigerator units
- cleaning solvents
- scrap metal
- wooden pallets
- laser printer cartridges
- aluminum and tin cans
- glass
- plastics (1 & 2 only)
- newspaper
- white and mixed paper
- corrugated cardboard
- boxboard
- books and magazines
- transparencies, and
- tyvek envelopes

Several central recycling locations are available for most recycling needs throughout NREL facilities. NREL also offers a chemical redistribution program where chemicals in original containers are made available to staff at NREL and other DOE facilities to be reissued for research activities at no cost. The process for redistributing chemicals to new users has been improved by the implementation of the chemical management system (CMS).

When possible, NREL purchases products with recovered content. In 2001, some of the products purchased containing recovered content included carpeting, uncoated-printing paper, toner cartridges, file folders and notepads.

3.6.2. Permitting

NREL has four separate sites that have the potential to produce limited quantities of hazardous materials. Each of the four sites has a Resource Conservation and Recovery Act (RCRA) waste generator identification number issued by the State of Colorado. The South Table Mountain and Denver West Office Park locations are classified as "small quantity generators," generating less than 1000 kg of waste per month. The other two sites, the Joyce Street Facility and the National Wind Technology Center, are classified as "conditionally exempt small quantity generators," generating less than 100 kg of waste per month.

3.6.3. 2001 Activities

In 2001 NREL generated 27,780 pounds (12,627 kg) of hazardous waste, and 4830 pounds (2,195 kg) of non-RCRA regulated waste. The total volume of hazardous waste included 2,585 pounds (1,175 kg) of batteries. The total amount of fluorescent bulbs shipped for recycling was 600 pounds (273 kg). These quantities are approximations only. The materials are normally not weighed when picked up by disposal or recycling vendors. Typically, a vendor will provide its good faith estimate of quantity based on practical experience.

A small quantity of low level radioactive waste was shipped for off-site disposal in 2001, which included 482.32 MBq (0.013 mCi) of carbon-14, 0.092537 MBq (2.5×10^{-6} mCi) of tritium, and 4.144 MBq (0.0001 mCi) of uranium-239. Most of the radioactive waste shipped for disposal in 2001 resulted from the RAMP Industries, Inc. site abandonment and EPA emergency response, and details of this are included in Section 3.14.1. Information regarding the types and quantities of radioactive materials used at NREL facilities is detailed in Section 3.14.

In 2001, NREL participated in the DOE Exchange program by sharing the list of chemicals available for redistribution with other DOE facilities. This effort may contribute to waste reduction within the DOE organization.

3.7. Storage Tanks (Underground and Above Ground)

3.7.1. Program Management

Management in this area is consistent with the following NREL programs: Aboveground Storage Tank Management (6-2.7) and Spill Prevention Control and Countermeasures (6-2.10)

NREL facilities no longer have any underground storage tanks. Instead, NREL facilities store diesel for emergency generator and research use in aboveground storage tanks. The NREL tank inventory is presented in Appendix A. NREL's tank management program focuses on proper tank design, operation, and inspection to protect against spills and leaks. The program is designed to meet regulatory requirements, and it is more stringent than the regulations require in many areas.

Several important safeguards have been incorporated into NREL's tank management program to prevent any accidental releases of diesel fuel from the storage tanks. These safeguards include both mechanical safeguards, such as double wall tanks with sensors that result in an alarm if the inner tank wall is leaking, overfill prevention, and spill protection; and procedural safeguards such as written operating procedures and tank filling procedures. All tanks larger than 110 gallons are visually inspected at least once per month.

Due to the quantity of diesel fuel stored on the STM site, a Spill Prevention Control and Countermeasures Plan is required to be in place. This Plan describes the site topography and neighboring areas, and outlines the steps necessary to mitigate any spills or leaks of diesel fuel. To date, NREL has not had any offsite impacts related to tank activities.

3.7.2. Permitting

Tanks larger than 660 gallons are required to be registered with the State of Colorado, with the registration renewed annually. Currently, only two tanks meet the registration threshold, the SERF emergency generator diesel storage tank and the Process Demonstration Unit (PDU) ethanol storage tank at the Alternative Fuels User Facility (AFUF), both located on the STM site. In 1999 the State inspected each of NREL's registered tanks, and found no deficiencies in the management or operation of the tanks.

3.7.3. 2001 Activities

In April 2001, an operational surveillance of NREL's Spill Prevention Control and Countermeasures (SPCC) Program was conducted by the DOE Golden Field Office in cooperation with NREL. The surveillance effort included review of applicable State and federal regulations, and a review of NREL's SPCC Plan for the STM. The surveillance team also performed a site visit at several storage fuel tanks located at the STM and interviewed NREL personnel responsible for regulated facilities or materials.

The surveillance team concluded that NREL's SPCC Plan for the STM was clearly documented and met or exceeded the requirements of the applicable State and federal regulations. NREL ES&H staff members were found to provide excellent program management and oversight as well as support for the implementation process. Facility and maintenance personnel were well informed regarding the requirements of the program and closely follow SPCC Plan

guidelines. Employees were knowledgeable regarding emergency response procedures. Observations noted in the surveillance report involved updating the emergency contact lists, adding location of manholes to the site map, and providing copies of the plan in facilities located near storage tanks. Since fuel tank management activities at the NWTC are not currently addressed in a site-specific SPCC plan, a review is needed to determine if a SPCC plan is required at that site.

There were no spills or leaks from NREL tanks during 2001. No state inspection was performed in 2001. The 2002 inspection will be discussed in the 2002 annual report.

3.8. Hazardous Materials Management

3.8.1. Program Management

Management in this area is consistent with the following NREL programs: Chemical Safety Program (6-4.6), and Asbestos Management Program (6-4.18)

No hazardous waste sites have been identified on any of the Laboratory sites. Therefore, many sections of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) do not apply to NREL facilities.

However, NREL sites are subject to the emergency reporting sections of CERCLA that require the reporting of any releases of reportable quantities (RQ) of chemicals. During 2001, the Laboratory had no releases to the environment of chemicals reportable under this section.

NREL facilities are also subject to the emergency reporting requirements in Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-To-Know Act (EPCRA). These regulations require a facility to notify the State Emergency Response Commission that it is subject to emergency planning and notification requirements if any chemicals in the facility's inventory are stored in quantities greater than prescribed threshold planning quantities (TPQs). NREL facilities first became subject to planning and notification requirements in 1988.

There are also reporting requirements in the event of a release of an RQ of any hazardous substance listed by EPCRA. In 2001, NREL facilities had no release exceeding the RQ of any reportable material under EPCRA.

NREL provides Material Safety Data Sheets (MSDSs) for chemicals that are stored on-site in quantities greater than TPQs, and provides inventory reporting for these same chemicals in the form of Tier I or Tier II reports to emergency planning and response groups. While NREL facilities currently have no chemicals on-site that exceed TPQs, the Laboratory has submitted MSDSs and Tier II reports in the past when required.

NREL provides emergency response and reporting information to the Jefferson County Emergency Planning Committee (EPC), the State Emergency Response Commission, and West Metro Fire Protection District when requested. The Jefferson County EPC uses Uniform Fire Code hazard categories and threshold reporting quantities rather than those specified in SARA Title III, resulting in a larger number of individual hazard categories and lower reporting thresholds. NREL has an active involvement in the emergency planning concepts of SARA Title III, in that the Laboratory currently has an acting member on the Jefferson County EPC, and has been so represented since the EPC's inception.

SARA Section 313 requires that a toxic chemical release inventory report (Form R) be filed with EPA for any chemical that is manufactured, processed, or otherwise used in quantities exceeding TPQs. Although NREL is not a manufacturing facility and does not fall within any of the Standard Industrial Classification (SIC) codes for which Section 313 reporting is required, Executive Order 12856 requires all federal facilities to file a report, if applicable, regardless of SIC code. As a research and development Laboratory, NREL does not manufacture or process any materials, and during 2001, the Laboratory did not use any materials on the Section 313 list in quantities exceeding the 4536-kg (10,000-lb) threshold planning quantity.

A Laboratory-wide chemical management system (CMS) was implemented at NREL in 1999. It serves as a centralized chemical inventory as well as a tool for managing and reporting on chemicals used at the Laboratory. Using an electronic barcoding system, the CMS tracks chemicals from the point of receipt through disposal. Key functions of the system include:

- Providing current inventories by room, building, and/or site
- Improving research efficiency and minimizing hazardous waste generation by allowing staff to determine if needed chemicals are already available on site prior to making chemical purchases
- Providing quick access to chemical inventories and hazard information during emergency responses
- Facilitating accurate and efficient reporting to external agencies (e.g. fire districts, EPC, EPA, DOE)

To populate the CMS database, a physical inventory of each lab and work area in which chemicals are used or stored was conducted between June 1999 and the first quarter of 2000.

In 2000, technical data and reporting information was entered into the system for many of the chemicals in the CMS database.

NREL has not identified any areas within its facilities that contain residual contamination requiring special decommissioning. Asbestos surveys have been conducted in a number of NREL facilities: Joyce Street Facility; Building 251 at the NWTC; Building 16, and at the STM Site the AFUF (only older areas of the building), FTLB and SRRL. No asbestos was found at the Joyce Street Facility

and the AFUF. The other facilities have limited amounts of asbestos-containing material in areas such as floor tile, lab countertops, caulking and sealants, and roofing material. Asbestos-containing materials are left undisturbed whenever possible. If renovation is planned that will disturb asbestos-containing material, then certified asbestos removal contractors are used and strict asbestos removal procedures are followed. An Asbestos Management Program is in effect for all NREL facilities.

3.8.2. Permitting

In 2001 NREL received Hazardous Material Permits from West Metro Fire Protection District. The permits are required by the Uniform Fire Code and the West Metro Fire Protection District and were issued by building. NREL obtained permits for a total of 7 buildings where hazardous materials are stored and/or used. Prior to issuing the permits, a representative from West Metro Fire Protection District conducted a walk-through inspection of the entire South Table Mountain Site and DWOP in May of 2001. There were no recommendations resulting from this inspection.

3.8.3 2001 Activities

The CMS was used to provide hazardous materials aggregate summary information to West Metro Fire Protection District when applying for Hazardous Materials Permits in 2001. The CMS was also used to post individual laboratory chemical inventories on the ES&H website, which were updated monthly. In 2001, the search capabilities of the ES&H website were expanded to allow users to search for individual chemicals.

A complete reinventory was conducted between August and October of 2001. The reinventory process involved verifying the inventory accuracy, as well as updating the hazard classification records. The results of the reinventory indicated that the NREL staff is in fact using the CMS as designed to track chemicals in their work areas.

3.9. Vegetation Management

3.9.1 Program Management

Management in this area is consistent with NREL's Weed Management Programs for the STM and NWTC (6-2.12 and 6-2.13, respectively).

NREL's basic philosophy regarding vegetation is to preserve and protect the ecosystems on the site in their natural state as much as possible. There is some landscaping using non-native drought-tolerant species adjacent to some of the buildings, and even a few areas at the STM site of sodded bluegrass. However the native vegetation and natural character of the landscape is maintained over the majority of the site. Revegetation of areas to be left in their natural state following disturbance from construction or other outdoor activities is conducted

using a native seed mix of grasses and forbs. This mix is comprised predominantly of natives that were originally present on the site before disturbance. The use of native species is strongly encouraged at both the STM and NWTC sites whenever feasible.

A vegetation survey of the STM site was conducted in support of the 1993 site wide Environmental Assessment, and a site reconnaissance was performed by Dames & Moore biologists in November 1997 (U.S. DOE, 1998, page 3-1).

In 1999, a verification survey of STM site vegetation was performed on the Conservation easement property to identify any changes to habitat character or species types that may have occurred since the 1993 and 1997 surveys. An effort was made to determine whether any sensitive species or habitats that could potentially support such species were present on the site. No sensitive species or potential habitats were identified on the STM site.

A vegetation survey of the STM was conducted between June 2001 and May 2002. Details of the survey results are included in Section 3.9.3.

A three-season vegetation survey of the NWTC site was performed between August 1999 and August 2000. The survey defined five general habitats on the NWTC site, comprising nine plant communities and 271 vascular plant species (Plantae Consulting Services, 2000). No rare or imperiled plant species were found on the site. However, the survey identified a small area of xeric tallgrass prairie (defined as mesic mixed grassland in this study) located in the southwest corner of the NWTC. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal designation or regulatory enforcement. It is made primarily for management purposes. This area of the NWTC is not impacted by research or construction activities on the site.

The survey identified eleven noxious weed species on the NWTC site. Five of these are recognized as belonging to the top ten prioritized weed species in Colorado. Based on the survey, recommendations were made to continue using a comprehensive weed management program, based on integrated pest management (IPM) philosophy.

The survey showed the native seed mix used for revegetation at the NWTC to be very successful in many areas of the site. NREL is continuing the use of this seed mix for revegetation at the NWTC.

Weed control efforts have been ongoing since 1997 at the NWTC and 1998 at the STM site. NREL uses an IPM approach that incorporates various types of weed control methods. Some of these include mechanical practices (e.g. mowing), cultural (reclamation of disturbed areas), prevention (e.g. limiting or eliminating driving of vehicles off established roadways), and herbicide treatment. The effectiveness of control methods is periodically assessed. The use of multiple strategies for control has been successful in significantly

reducing populations of diffuse knapweed and Canada thistle on the sites. The key aspect of the weed control program is to maintain flexibility to respond to the changes in weed populations from year to year.

In 1998, aerial herbicide application of Tordon 22K was conducted using helicopter application over about 200 acres of the NWTC to target diffuse knapweed. It has been very effective in controlling the weed, and healthy stands of native grasses have proliferated with the decrease in weed competition. Also at the NWTC in 1998, sensitive areas adjacent to drainage areas and trees were treated using ground application with the herbicide, Transline, to control diffuse knapweed, and small areas of Canada thistle were treated with Telar. Limited herbicide application occurred in 2000 and 2001, which included spot spraying using tractor and backpack applicators to target remaining pockets of diffuse knapweed and Canada thistle. More regarding 2001 herbicide application are provided in Section 3.9.3.

Weed infestations at the STM site are much less severe than at the NWTC. Limited ground application of herbicides has been conducted at the STM from 1999-2001, applying Transline and Tordon to diffuse knapweed and Telar to Canada thistle infested areas.

3.9.2 Permitting

There is no permitting applicable to vegetation management, although there is a State weed law that requires property owners to control certain species of invasive weeds (e.g. diffuse knapweed). For application of certain types of herbicides designated as “restricted use” by EPA, a certified applicator must be used. Herbicide applications at NREL are always performed by a certified applicator. The exceptions are herbicides used for control of undesirable vegetation along walkways, roadways, and adjacent to facilities. These are typically Round-Up and Weed-B-Gon and are applied by NREL Site Operations staff pursuant to an NREL Safe Operating Procedure (SOP).

3.9.3 2001 Activities

While NREL applies a variety of IPM practices, limited ground applications of herbicides occurred at the NWTC and STM in 2001. At the NWTC, spot spraying using tractor and backpack applicators was performed to target remaining pockets of diffuse knapweed and Canada thistle. Tordon and Transline were used to target diffuse knapweed. Tordon was applied in dry upland areas, while Transline was used near drainage areas. Tordon was also applied to small patches of leafy spurge. Telar was used to target Canada thistle. Escort was used in limited applications for common teasel, hoary cress, and sulfur cinquefoil. At the STM, Transline was applied to diffuse knapweed near drainage areas and near neighbor’s fence lines, while Tordon was used for diffuse knapweed in dry upland areas. Telar was applied to Canada thistle at the STM.

A vegetation survey of the STM was conducted between June 2001 and May 2002. Five general habitats were described on the STM site, comprising seven plant communities (Plantae Consulting Services, 2002). No rare or imperiled plant species were found in suitable habitat on the site. An area of mixed foothills shrublands was identified along the top of the mesa within the conservation easement area. While that natural community is listed as rare and imperiled by the Colorado Natural Heritage program, the listing implies no legal designation or regulatory enforcement. The listing is made primarily for management planning purposes. This area of the STM is minimally impacted by existing research facilities or other disturbances.

Eleven noxious weed species were located on the STM site. Four of these belong to Colorado's top ten prioritized-for-control weed species. These four include Canada thistle, diffuse knapweed, field bindweed, and musk thistle.

3.10. Endangered Species/Species of Concern

3.10.1. Program Management

The Endangered Species Act provides for the designation and protection of wildlife, fish, and plant species that are in danger of extinction and preserves the ecosystems on which these species depend. A wildlife survey was completed on the STM site in 1987 (The FORUM Associates, Inc., 1987a), at which time no threatened or endangered species or candidate wildlife species for endangered designation were found. A vegetation survey of the STM site was completed in 1999 for the *National Renewable Energy Laboratory (NREL) Site Conservation Easement Baseline Inventory* (U.S. DOE 1999). No threatened, endangered, or candidate plant species were identified in the survey. The most recent vegetation survey was completed between June 2001 and May 2002. Details of the survey are presented in Section 3.9.3. The survey found no rare/or imperiled plant species in suitable habitat on the site.

Additional surveys of wildlife on the Conservation easement property were conducted in 1999, also for the Baseline Inventory. The U.S. Fish and Wildlife Service lists five threatened and endangered animal species that may potentially occur in the property area, including American peregrine falcon, bald eagle, Eskimo curlew, Mexican spotted owl, and Preble's meadow jumping mouse. The Colorado Natural Heritage Program database lists three animal species of interest that may potentially occur in the property area, including common shiner, arogos skipper, and ottoe skipper. No suitable habitat is present for any of these species on the Conservation easement property.

No threatened, endangered, or candidate species of either plants or animals have been identified to date on the NWTC site. A vegetation survey conducted between August 1999 and August 2000 identified a small area of xeric tallgrass (defined in the survey as mesic mixed grassland) prairie located in the southwest corner of the NWTC site. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal

designation, but is made primarily for management planning purposes. This area is not impacted by current research and construction activities.

Field research into avian use of the NWTC was conducted during 1994 and 1995 in an effort to identify potential impacts on birds from wind-turbine research. While several species of raptors, including red-tailed hawks, kestrels, and a great-horned owl were noted on the site, they were primarily transient in nature. The NWTC appears to be used primarily for loafing and hunting, although one pair of kestrels nested in an old concrete pole during the spring. Birds of prey of concern, such as eagles, generally fly in excess of 152 m (500 ft) over the site. No significant impacts to the birds from NREL activities were found.

The most recent research conducted for avian and bat use of the NWTC was conducted between May 2001 and July 2002. Details of the preliminary study results are included in Section 3.10.3. Final study results will be included in the 2002 report.

3.10.2 Permitting

NREL has no permitting requirements for this area of environmental management.

3.10.3 2001 Activities

A year-long monitoring project for birds and bats was initiated on the NWTC in early 2001. Starting on May 30, 2001, standardized plot surveys were conducted to survey songbirds and raptors on the NWTC and adjacent, undeveloped areas. As of July 31, 2001, 15 species of songbird were recorded on the NWTC. The five most common species were vesper sparrow, western meadowlark, European starling, black-billed magpie, and cliff swallow (Armstrong et al., 2001). Several species of raptors were also observed on the NWTC; the most abundant species were American Kestrels and Red-tailed Hawks.

Starting on May 29, 2001, NREL began conducting systematic searches of turbines and meteorological towers on the NWTC to document avian mortality. The study was completed in July 2002. As of November 15, 2001, three avian fatalities had been found, including a yellow-rumped warbler found under a guy wire supporting a meteorological tower, and American kestrel under a small turbine, and a black-billed magpie under a turbine with a lattice base (Armstrong et al., 2001).

As part of the bird and bat survey at the NWTC, data collection to determine bat species composition and use of the area began in June 2001. Initial trapping surveys with mistnets have documented the presence of fringed myotis and big brown bats near the site. In August and September 2001, bat species were documented on the NWTC itself using bat detectors. The species identified included hoary bat, silver-haired bat, Mexican freetailed bat, long-legged myotis, small-footed myotis, and little brown myotis. Several bats have been observed

on and near the NWTC foraging at heights similar to those occupied by turbine blades (Piaggio, 2001). Searches for bat carcasses near turbines have been conducted since late May 2001. No bat mortalities have been found at the site.

A vegetation survey of the STM was completed between June 2001 and May 2002. Details of the survey are presented in Section 3.9.3. The survey found no rare/or imperiled plant species in suitable habitat on the site (Plantae Consulting Services, 2002). An area of mixed foothills shrublands was identified along the top of the mesa within the conservation easement area. While that natural community is listed as rare and imperiled by the Colorado Natural Heritage program, the listing implies no legal designation or regulatory enforcement. The listing is made primarily for management planning purposes. This area of the STM is minimally impacted by existing research facilities or other disturbances.

3.11. Wetlands/Floodplains

Limited wetland areas totaling less than 0.2 ha (0.50 ac) occur on the STM site in the drainage bottom located north of the Visitor's Center. These are narrow, linear wetlands supporting spikerush, baltic rush, sedges, bluegrass, hemlock, and field mint. These wetlands will be protected from adverse impacts as site development continues.

Wetland areas at the NWTC are extremely limited in extent as well. These areas, along the site's eastern boundary, total less than 0.4 ha (1 ac).

According to maps generated by the Jefferson County Department of Highways and Transportation as part of its urban drainage studies, NREL's STM site does not contain any floodplains, and no floodplains have been identified at the NWTC. As a best-management practice, however, all construction activities that may cross a drainage channel are designed to meet the 100-year flood control standards (designed to withstand the equivalent of a 100-year flood).

3.12. Cultural Resources

Two formal surveys of historic and cultural resources have been performed on the STM site. These surveys were completed in 1980 and 1987. As a result of these surveys, three historical sites were recognized as significant cultural resources that should be preserved. These sites include an open-air amphitheater, a stone bridge spanning a natural drainage channel adjacent to the amphitheater, and a stone and concrete ammunition bunker below the amphitheater site. The three structures were constructed during the Works Progress Administration (WPA) era in the 1930s. Through NREL's efforts, these sites have been added to the National Register of Historic Places (National Register), with the amphitheater and stone footbridge listed together as a single site. NREL also participated in an interagency survey of South Table Mountain and Camp George West to identify historic structures and sites eligible for nomination to the National Register.

An archaeological survey of the NWTC site was conducted in support of the 1996 Environmental Assessment to supplement previous surveys so there were no gaps in cultural surveys on the site. No significant historical or archaeological resources were identified. However, the wooded ridge area on the west portion of the site was identified as a location with potential for cultural resources, so further testing or observation during excavation would be done should there be any future need for work in the utility corridor in the vicinity of the ridge.

3.13. National Environmental Policy Act (NEPA)

3.13.1. Program Management

Management in this area is consistent with NREL's NEPA Implementation Program (6-2.2).

As a federal agency, DOE is obligated to comply with NEPA by evaluating the potential for environmental impacts prior to conducting its activities. Regulations for compliance with the Act are issued by the Council of Environmental Quality (CEQ). DOE has also issued implementing regulations at 10 CFR that complement the CEQ requirements. DOE has written a site wide Environmental Assessment (EA) for its activity at the STM Site and DWOP, and separate EAs for the NWTC and JSF activities.

NREL has established procedures, with the approval of the DOE GO, to assist DOE in meeting their NEPA obligation. Proposed activities that will be conducted off of NREL's four sites are evaluated for their potential environmental effects using the appropriate level of NEPA review, in conjunction with GO.

The NREL NEPA Handbook has been prepared to provide NREL project managers and procurement specialists with guidance on implementing the NEPA procedures.

3.13.2. Permitting

NREL has no permitting requirements under NEPA.

3.13.3. 2001 Activities

During 2001, activity continued on developing EAs for 3 potential sites for small-scale geothermal power plant construction. In 2001 site visits were made for a second time at all three sites including Empire, Nevada, Animas, New Mexico, and Newcastle, Utah. An EA was begun in 2000 for a geothermal site in Empire, Nevada and continued in 2001. The EA for the Newcastle, Utah site was initiated in 2001, then put on hold in early 2002. The EA will not be completed, as the project will not proceed to the construction phase. The EA for

the Animas, New Mexico site was also initiated in 2001 and a FONSI was signed for the site in 2002.

Project information for several geothermal direct use projects was reviewed in 2001. The EA process was initiated in 2002 for one of these projects, which is located in Canby, California.

In 2001 a subcontractor was hired and began writing the new Site wide EA for the NWTC, and the EA was completed in May 2002.

Internal scoping began in 2001 for the new Site wide EA for the STM. In 2002 the contractor was hired and began writing the EA. The EA for the STM is scheduled to be completed in late 2002.

In addition to the EA activity, numerous NEPA reviews of both onsite and offsite activities occurred through completion of NREL Environmental Checklists. As outlined in NREL's NEPA implementation procedures, these reviews were coordinated with NREL project managers, subcontracting staff, the NREL NEPA Coordinator, and the DOE Golden Field Office NEPA Compliance Officer. NEPA requirements were also coordinated with future program planning through interaction between NREL's NEPA Coordinator and NREL's Technology Program and Project Managers.

3.14. Radiological Program

3.14.1 Program Management

Management in this area is consistent with the following NREL programs: Air Quality Protection (6-2.5), and Radiological Control (6-4.5).

All radioactive material at NREL facilities are handled according to NREL's Radiological Control Program. Elements of the program include a radiological control organization, a radiation safety policy and control manual, safe operating procedures, safe work permits, radiological control areas and postings, monitoring, training, and purchasing controls for radioactive materials.

There are no nuclear operations at NREL sites. The majority of radiation sources are used/stored in facilities located on the STM site. These include three x-ray diffraction machines at the SERF and two sealed source level gauges at the AFUF used on pilot scale processes to measure the level of material inside process tanks. In addition, two laboratories at the Field Test Laboratory Building (FTLB), on the STM site, occasionally use small quantities of radioisotopes for biological or chemical labeling, and in 2001 one laboratory in the SERF used a small quantity of depleted uranium to perform temperature dependant conductivity and photoconductivity measurements.

The three X-ray diffraction machines are registered with the State of Colorado and are inspected every two years by a state-licensed surveyor. The surveyor

inspects and certifies the X-ray machines and audits NREL's program for radiation safety in connection with operating the machines. An inspection of one of the X-ray diffraction machines was performed in February 2001, and the other two machines were re-inspected in November 2001. Re-certification will occur in two years.

Personal monitoring by way of thermoluminescence dosimeters (TLDs) is performed on NREL personnel who are working with x-ray machines or in labs where P-32 radioisotopes are handled or stored. C-14, S-35, and H-3 cannot be detected using the TLDs. Each worker wears a TLD that is sent to a laboratory for analysis at least once every quarter. In 2001 there were TLD monitoring results for 21 people. All of the exposure results were at background levels, with the exception of the result for one worker. This researcher used P-32 in accordance with Radiation Safe Operating Procedure #663, and during the first quarter in 2001 his ring badge received a dose result of 0.63 rem, which was about 1 % of the annual extremity (e.g. hand) limit of 50 rem. Although this exposure was above background, it was well below the allowable annual limit. The work practices of this researcher were reviewed by NREL's Radiation Safety Officer, and it was determined that no unusual handling activities occurred that would have contributed to this low exposure. Workers periodically have low exposures while working with P-32 given it is a high-energy beta emitter. Exposures during the remainder of the year for this activity were at background levels.

Monitoring of equipment and facilities for removable contamination is performed in the laboratories where radioisotopes are used. Wipe tests are performed on any laboratory surfaces that could have become contaminated by the radioisotope work at least monthly and more frequently if needed. These wipes are analyzed using a scintillation counter.

U.S. Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment," established radiation emission limits for DOE facilities. Such emissions are also regulated by Section 112 of the Clean Air Act as implemented by 40 CFR 61, Subpart H, established by the U.S. Environmental Protection Agency (EPA). According to 40 CFR 61, Subpart H, all DOE facilities, including NREL, must annually demonstrate compliance with the radionuclide emission limit to the ambient air not exceeding an amount that would result in any member of the public receiving an effective dose of 10 mrem/yr or greater. No radioactive air-emission monitoring is conducted at NREL because of the extremely low usage of radioactive material. Therefore, NREL demonstrates compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR 61, Subpart H, by utilizing the EPA's COMPLY computer model to determine the effective dose equivalent to the public.

During 2001, the total quantity of radioisotopes used was 2.016 mCi used in one laboratory at NREL's FTLB and one laboratory at the SERF. Any emissions generated by this work were emitted by a laboratory hood exhaust. In addition,

much of NREL's radioisotope inventory (including waste quantities) is in containers on which the manufacturer's original seal was broken. In 2001 the potential dose to the public was calculated as though the contents of all unsealed containers was exhausted to the atmosphere, including the amount actually used in 2001. P-32 and S-35 waste that is stored in the Waste Handling Facility and has decayed past ten half-lives was not included in this calculation.

The distance from the source in the FTLB to the nearest potential receptor is 119 m (fence line of nearest resident). For the SERF, the distance from source to the nearest potential receptor is 256 meters. For the WHF, the distance from the source to the nearest potential receptor is 311 m. These distances are greater than in previous reports due to a land acquisition and resulting changes in site boundaries.

According to the COMPLY computer model, the potential dose to the nearest member of the public is 0.2 mrem/yr, below the emission limit of 10 mrem/yr, and NREL is in compliance with the NESHAP for radionuclides. Because the dose is calculated rather than measured, it represents a potential or estimated rather than an actual dose.

The resulting calculated off-site whole body doses are small, but are still likely overestimates of potential radionuclide doses. The COMPLY formula assumes that the entire quantity of the radionuclide in all open containers was released, and that the receptor raises and consumes all his/her own milk, meat, and vegetables at home. These assumptions are extremely conservative.

All radioactive waste generated during NREL activities is classified as low level waste. Waste from the STM site is temporarily stored at the Waste Handling Facility (WHF) until disposal is arranged at an offsite facility permitted to accept low level radioactive waste. The total amount of low level radioactive waste shipped off-site for disposal in 2001 was as follows: 482.32 MBq (0.013 mCi) of C-14, 4.144 MBq (0.0001mCi) of U-239 and 0.092537 MBq (2.5×10^{-6} mCi) of H-3. This waste included the disposal of approximately 300 pounds of radioactive waste resulting from the RAMP Industries, Inc. site abandonment and EPA emergency response. This waste, shipped to RAMP Industries, Inc. on June 24, 1993 and returned to NREL October 23, 1995, had been in storage at NREL's WHF pending authorization for final disposal. During this storage period, NREL complied with the EPA's requirements regarding the storage of RAMP-related waste, and provided an annual status report detailing this storage. On January 22, 2002, the EPA provided documentation to NREL stating we had properly complied with the terms of the storage and disposal agreement, and EPA considers the matter closed.

3.14.2 Permitting

NREL does not have a radioactive materials license from the State of Colorado, as the Laboratory is currently under DOE jurisdiction for radioactive materials handling.

3.14.3 2001 Activities

During 2001, the total quantity of radioisotopes used was 2.016 mCi, and included the use of C-14, P-32, H-3, and depleted U-238. NREL's total inventory of radioactive isotopes (excluding waste) at year-end 2001 (inventory taken in January 2002) is as follows:

<u>Isotope</u>	<u>Activity</u>
C-14	6.079 mCi (7.9×10^7 Bq)
S-35	0
H-3	1.0 mCi (3.7×10^7 Bq)
P-32	0.36 mCi (1.3×10^7 Bq)
Total 7.439 mCi (1.29×10^8 Bq)	

In 2001 NREL performed a self-assessment of the Radiation Safety Program and the management of radioactive waste. This assessment was conducted by an independent health physicist. As a best management practice, the assessment criteria were based upon State of Colorado radiation safety standards, these standards being the most suitable for the risks present at NREL. Overall, the self-assessment findings indicated that NREL's programs were performing well, and included only minor deficiencies.

In 2001 there was no construction or modifications to the labs where radioisotopes are used.

There were no unplanned releases of radioisotopes in 2001.

4. GREENING OF THE GOVERNMENT THROUGH LEADERSHIP IN ENVIRONMENTAL MANAGEMENT

In March 2000, Executive Order 13148, Greening the Government Through Leadership in Environmental Management was issued, requiring that all Federal agencies ensure that environmental accountability is integrated into day-to-day decision making and long-term planning processes. In February 2001, DOE issued a notice (DOE N 450.4) outlining requirements for DOE contractors under Executive Order 13148. NREL is complying with these requirements as detailed in this section.

Environmental Management Systems:

Under this executive order DOE facilities are required to implement an Environmental Management System (EMS) as part of a Integrated Safety Management (ISM) System. During the development and implementation of the NREL ISM system in 1998 through 2000, the Lab took a number of actions to ensure the EMS was part of ISM. The Environmental Management Policy (6-2) and 16 supporting Lab-level programs that define the NREL EMS were carefully coordinated and linked with the ISM Policy (2-1), the ES&H Policy (6-1), the supporting ES&H Policies (6-3 through 6-6), and

approximately 40 supporting Lab-level safety and health programs. The EMS is further integrated with ISM via task specific procedures that flow down from the policies and programs, such as Safe Operating Procedures (SOP).

In 1999 NREL operations were assessed against the criteria defined in ISO 14001. Policies and programs were revised as necessary to incorporate the applicable ISO criteria for the hazards and operations present at NREL.

With support from Midwest Research Institute a self-assessment of all environment, safety and health programs was conducted in 1998 and 1999 against a commercially available audit criteria, the Common Audit Process (CAPTM). Use of these audit criteria gave added confidence that environmental management programs were fully integrated with safety and health programs, and that the majority of ISO 14001 criteria for an EMS were met. Based on the self-assessment results, necessary changes were made to the policies and programs.

Environmental Management System Auditing:

NREL has EMS auditing processes in place for the set of policies, Lab-level programs, and task specific procedures. NREL reviews its ES&H policies as needed, but at least every 3 years, and makes revisions as necessary. In coordination with the Golden Field Office (GO) ES&H Surveillance Program, NREL has established an ES&H self-assessment program. A specific set of Lab-level programs are selected for assessment each year based on criteria established by the NREL/GO Operations Team, with the selected set including environmental programs that are part of the EMS. The EMS Lab-level programs evaluated in 2000 include the Aboveground Storage Tank Management Program (6-2.7) and the Storm Water Pollution Prevention Programs for the STM and NWTC (6-2.15 and 6-2.16, respectively). In 2001, the Spill Prevention Control and Countermeasures Program (6-2.10) was evaluated. Details of the surveillance and self-assessment of that program are presented in Section 3.7.3. In 2002 an assessment of NREL's environmental management processes will be completed. Results of this assessment will be presented in the 2002 report.

All SOPs are reviewed on an annual basis and are revised as necessary to help ensure the required controls are appropriate for the hazards present. Environmental hazards and controls are specifically called out in each SOP.

EPCRA Compliance and Prevention of Toxic Releases:

E.O. 13148 maintains requirements for SARA Title III, Emergency Reporting and Community Right-to-Know Act (EPCRA) compliance and Toxic Release Inventory reductions for government facilities. NREL maintains hazardous materials permits with and provides chemical inventory information to the authorities having jurisdiction (e.g. fire districts, haz mat teams) under EPCRA.

In 2001, NREL facilities had no release exceeding the reportable quantity (RQ) of any reportable material under EPCRA.

As a research and development laboratory, NREL does not manufacture or process any materials, and during 2001, the Laboratory did not use any materials on the SARA

Section 313 list in quantities exceeding the 4526-kg (10,000 lb) threshold planning quantity.

NREL's compliance with EPCRA requirements is detailed in Section 3.8.

NREL maintains an Emergency Management Policy (8-4) and supporting lab-level programs, including an Emergency Response Team Program (8-4.1), for credible on site emergencies. Hazardous material releases are specifically called out as a credible emergency, and response procedures are in place. These procedures are routinely practiced by internal response groups and with external emergency response agencies.

Pollution Prevention Initiatives:

As a facility that focuses on renewable technologies, NREL is committed to a pollution prevention program. NREL addresses pollution prevention through the Waste Management and Minimization Program (6-2.8), waste minimization criteria incorporated into all SOPs under the Hazard Identification and Control Program (6-6.2), and a recycling program managed by a volunteer committee that includes representative members from NREL's Staff Council. Details of NREL's pollution prevention program are outlined in Section 3.6.

Wetlands Protection:

Limited wetland areas totaling less than 0.2 ha (0.50 ac) occur on the STM site in the drainage bottom located north of the Visitor's Center. These are narrow, linear wetlands supporting spikerush, baltic rush, sedges, bluegrass, hemlock, and field mint. These wetlands will be protected from adverse impacts as site development continues.

Wetland areas at the NWTC are extremely limited in extent as well. These areas, along the site's eastern boundary, total less than 0.4 ha (1 ac), and will also be protected from adverse impacts.

Floodplains Management:

According to maps generated by the Jefferson County Department of Highways and Transportation as part of its urban drainage studies, NREL's STM site does not contain any floodplains, and to date, no floodplains have been identified at the NWTC. As a best-management practice, however, all construction activities that may cross a drainage channel are designed to meet the 100-year flood control standards (designed to withstand the equivalent of a 100-year flood).

Actions undertaken by NREL at subcontractor facilities are assessed for potential impacts on floodplains at those sites through the use of an environmental checklist.

Sustainability Practices:

Sustainable landscaping is an integral part of the planning that occurs prior to construction and renovation, as well as day-to-day maintenance, of NREL facilities. NREL's basis philosophy regarding vegetation is to preserve and protect the ecosystems on the site in their natural state as much as possible. For the most part, the native vegetation and natural character of the landscape is maintained at the STM and the NWTC. Revegetation of areas disturbed from construction or other outdoor activities is

conducted using a native seed mix of grasses and forbs. The use of native species is strongly encouraged at both the STM and NWTC whenever feasible. Details of NREL's vegetation management programs and activities are outlined in Section 3.9.1.

NREL also focuses on sustainability by incorporating sustainability building features in the conceptual design phases of major facilities, implementing building efficiency improvements, encouraging public transportation by providing RTD Eco-Passes to employees, and subscribing to the Xcel Energy *Green Power* program.

In FY 2001, NREL established the Sustainable NREL Initiative to pursue additional areas of sustainability improvement. As an outcome of that initiative, an NREL Sustainability Master Plan was approved in 2002 that details goals and implementation strategies to advance sustainability at NREL. More information about specific activities will be provided in the 2002 report.

Class 1 Ozone-Depleting Substances (ODSs) Phase-Out

NREL has controls for the use of ODSs in the Ozone-Depleting Substances Management Program (6-2.6). Section 3.1.1 details NREL's servicing and registration of equipment containing ODSs.

Halon-based fire suppression systems used at NREL were eliminated by 1999, with all supplies of Halon being transferred to other DOE facilities for "banking".

5. CONSERVATION EASEMENT LANDS

During 1999, DOE placed 177 acres of the STM site in a Conservation Easement. The purpose of the Conservation Easement is to preserve the natural character of the property, including its visual, biological, and recreational resources, especially in relation to the changing land uses adjacent to the NREL site and within the region.

The goals of the easement are to:

- Retain, preserve and protect natural, scenic, ecological, and historical aspects of the conservation easement property;
- Protect the ecosystem of the South Table Mountain area and the sustainable habitat for biodiverse vegetation, birds, and terrestrial animals;
- Ensure the scenic and biological integration with adjoining open-space land;
- Prevent further industrial, commercial, or residential development of the conservation easement property; and
- Preserve the conservation easement property as natural open space.

A baseline inventory of the property was prepared in June 1999 to document the current condition of the easement property and to assess the conservation value of the property (Department of Energy, Golden Field Office, 1999). The baseline inventory includes a description of the geographical setting and adjacent property owners, access and use of the property by the public, and a description of the existing environmental conditions of the property (geology, hydrology, vegetation, wildlife, cultural resources). There are also photos incorporated into the report that document the condition of the property.

2001 Assessment of the Property:

During 2001 there was no NREL activity on the conservation easement property having the potential to degrade the environmental condition of the property. A site inspection was conducted by Jefferson County Open Space, NREL, and DOE during the summer of 2002. No degraded conditions or other environmental issues were found. Photos taken in 2000 showing the representative areas of the easement lands are included in Section 2 of this report.

6. NON-ROUTINE ACTIVITIES/SPECIAL PROJECTS

A complete re-inventory of the CMS was conducted between August and October of 2001. The re-inventory process involved verifying the inventory accuracy, as well as updating the hazard classification records. The results of the re-inventory indicated that the NREL staff is in fact using the CMS as designed to track chemicals in their work areas.

7. ENVIRONMENTAL OCCURRENCES

There was one environmental occurrence during 2001 at the STM site, and one at the NWTC.

At the STM site, on July 10, 2001, a small amount of floor stripper was spilled on the floor of SERF Lab W214. The spill was contained to a small area within the lab, and was easily cleaned up by the ES&H Office staff without any releases to the floor drains or the environment.

At the NWTC site, on September 18, 2001 a series of oil filled capacitors located in the Variable Frequency Drive overheated during operation of the dynamometer in the Dynamometer Test Facility (DTF). One capacitor leaked a small amount of oil inside the DTF, which was easily contained and effectively cleaned up. There was no environmental damage to the site and no reportable releases as a result of this incident.

8. SUMMARY OF ONGOING ENVIRONMENTAL ACTIVITIES

In 2002, a working group was convened to develop a master plan for future development of NREL's STM and NWTC sites. The plan is being developed with a 25 year outlook. More information on the master site planning effort will be provided in the 2002 report.

The 2002 Environmental Management System (EMS) Assessment evaluated NREL management processes with a focus on environmental components. It also evaluated the link between the EMS and NREL's sustainability initiative. The assessment resulted in recommendations for improving the EMS as well as synergies between the EMS and sustainability program to improve their effectiveness. In the upcoming year, NREL will be working to implement these recommendations.

9. REFERENCES

Armstrong, D., C. Bock, T. Piaggio, and E. Schmidt (2001). *NWTC Site wide Bat and Avian Impact Study Plan: May 1, 2001-July 31, 2002*.

EG&G Rocky Flats, Inc., (1992). *Rocky Flats Plant Site Environmental Report, January Through December 1992*. Golden, Colorado.

Handex of Colorado, Inc. (1997). *Groundwater Monitoring Report, South Table Mountain Site*. Golden, Colorado

National Renewable Energy Laboratory, (Draft). *ES&H Program Number 6-2.12, Weed Management Program, STM Site*. Golden, Colorado.

National Renewable Energy Laboratory, (1997). *National Renewable Energy Laboratory Environmental Report for 1995 and 1996*. Golden, Colorado.

National Renewable Energy Laboratory, (1999a). *National Renewable Energy Laboratory Five-Year Plan, 2000-2004*. Golden, Colorado.

National Renewable Energy Laboratory, (1999b). *NREL Policy Number 6-2, Environmental Management*. Golden, Colorado.

National Renewable Energy Laboratory, (1999c). *NREL Policy Number 6-6, Risk Assessment*. Golden, Colorado.

Piaggio, T., Doctoral Candidate, Environmental, Population, and Organismic Biology, University of Colorado, Boulder, telephone, communication. July 18, 2001.

Plantae Consulting Services, (2000). *Vegetation Survey, NREL National Wind Technology Center*. Boulder, Colorado.

Plantae Consulting Services, (2002). *Vegetation Survey, NREL South Table Mountain Site*. Boulder, Colorado

Rust Environment & Infrastructure, Inc., (1993). *Water Quality Monitoring, National Wind Technology Center*. Englewood, Colorado.

Rust Environment & Infrastructure, Inc., (1994a). *Final Report, Baseline Surface Water Monitoring Program: 1993*. Englewood, Colorado.

Rust Environment & Infrastructure, Inc., (1995a). *Report, Wastewater Monitoring Program, Fourth Quarter, 1994 and Annual Report*. Englewood, Colorado.

Rust Environment & Infrastructure, Inc., (1995b). *Final Report, Ground Water Monitoring, Third Quarter, 1994 and Fourth Annual Report, South Table Mountain Site*. Englewood, Colorado.

U.S. Department of Energy, Golden Field Office, (1999). *National Renewable Energy Laboratory (NREL) Site Conservation Easement Baseline Inventory*. Golden, Colorado.

U.S. Department of Energy, (1998). *Environmental Assessment, Right-of-Way Easement For Public Service Company of Colorado at the South Table Mountain Site, Golden, Colorado*. DOE/EA-1254.

U.S. Department of Energy, (1993). *Site wide Environmental Assessment for the National Renewable Energy Laboratory, Golden, Colorado*. DOE/EA-0850.

10. APPENDICES

Appendix A – Above Ground Storage Tank Inventory

Appendix B – Summary of NREL Environmental Permits, Registrations, Notifications

APPENDIX A - ABOVEGROUND STORAGE TANK INVENTORY

<u>Tank ID</u>	<u>Size</u>	<u>Contents</u>	<u>Class</u>	<u>Use</u>	<u>Date On-Line</u>	<u>Service Status</u>	<u>Date Last Change in Status</u>
No. 1	1010 gallons	Diesel	II	FTLB Emergency Generator (UST)	1983	Closed (6/96)	6/96
No. 2	800 gallons	Diesel	II	SERF Emergency Generator Double-walled, interstitial monitor, no secondary containment	10/93	In-Service	
No. 3	6000 gallons	Ethanol, 50%	IC	PDU Ethanol Storage Single-walled, remote monitoring, 7500 gal concrete containment	12/95	In-Service	
No. 4	564 gallons	Diesel	II	PDU Emergency Generator Double-walled, interstitial monitor, no secondary containment	8/95	In- Service	6/15/98 OS 9/11/98 IS
No. 5	560 gallons	Diesel	II	FTLB Emergency Generator Double-walled, interstitial monitor, concrete secondary containment	6/96	In-Service	
No. 6	400 gallons	Diesel	II	IUF Emergency Generator Double-walled, no secondary containment	3/97	In-Service	
No. 7	80 gallons	Diesel	II	251 Emergency Generator	1980	PC	
No. 8	500 gallons	Diesel	II	NWTC Hybrid Power Test Bed (HBTB) Convault, pop-up interstitial monitor	6/97	In-Service	
No. 9	500 gallons	Diesel	II	Bldg 16 Emergency Generator Single-walled, no interstitial monitor, 537-gal secondary containment	1990	In-Service	
No. 10	100 gallons	Diesel	II	NWTC NPS Daytank Double-walled, no interstitial monitor	6/96	In-Service	
No. 11	100 gallons	Diesel	II	NWTC HPTB North Daytank (SIM#1) Single-walled, no interstitial monitor	6/97	In-Service	

<u>Tank ID</u>	<u>Size</u>	<u>Contents</u>	<u>Class</u>	<u>Use</u>	<u>Date On-Line</u>	<u>Service Status</u>	<u>Date Last Change in Status</u>
No. 12	100 gallons	Diesel	II	NWTC HPTB South Daytank (SIM#2) Single-walled, no interstitial monitor	6/97	In-Service	
No. 13	50 gallons	Diesel	II	SunWize (West of HPTB) Single-walled, 36-gal steel catch basin	5/98	NC	
No. 14	200 gallons	Diesel	II	251 Stand-by Generator Double-walled, no interstitial monitor	9/98	In-Service	
No. 15	100 gallons	Diesel	II	AFUF Emergency Generator Double-walled, no interstitial monitor	6/94	TC	10/2000 TC
No. 16	50 gallons	Diesel	II	Bergey Hybrid System (Site 1.8) Double-walled, no interstitial monitor	1/00	NC	
No. 17	173 gallons	Diesel	II	NWTC Hybrid 80 (Sim #4) Double-walled, no interstitial monitor	3/01	In-Service	
No. 18	336 gallons	Diesel	II	NWTC Hybrid 125 (Sim #3) Double-walled, no interstitial monitor	3/01	In-Service	
No. 19	500 gallons	Propane	-	NWTC East Met Tower	-	NC	
No. 20	500 gallons	Propane	-	NWTC West Met Tower	-	NC	
No. 21	500 gallons	Propane	-	Capstone Micoturbine	-	NC	

Service Status

In-Service (IS)
Out-of-Service (OS)
Temporary Closure (TC)
Permanent Closure (PC)
Change-In-Service (CIS)
NC—not covered by this Program

APPENDIX B – SUMMARY OF NREL ENVIRONMENTAL PERMITS, REGISTRATIONS, NOTIFICATIONS

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
<i>Permits</i>								
1	00JE0010L	DOE	AIR	Air Emission Permit for Land Development (fugitive dust from construction activities)	Colorado Dept. of Public Health and Environment (CDPHE)	NWTC site	1/31/05 (issued 3/1/00)	N/A
2	95JE497L	DOE	AIR	Air Emission Permit for Land Development (fugitive dust from construction activities)	CDPHE	STM site	1/31/05 (issued 3/1/00)	N/A
3	COR10A59F	DOE	STORM WATER	Storm Water (sitewide) -- discharge associated with construction activities	U.S. Environmental Protection Agency (EPA)	NWTC site	2/17/03 (permit issued by EPA 2/17/98)	Internal updates to SPPP; internal weekly site inspections
4	COR10A60F	MRI	STORM WATER	Storm Water (sitewide) - discharge associated with construction activities	EPA	NWTC site	2/17/03 (permit issued by EPA 2/17/98)	Internal updates to SPPP; internal weekly site inspections
5	COR10A57F	DOE	STORM WATER	Storm Water (sitewide) - discharge associated with construction activities	EPA	STM site	2/17/03 (permit issued by EPA 2/17/98)	Internal updates to SPPP; internal weekly site inspections
6	COR10A58F	MRI	STORM WATER	Storm Water (sitewide) - discharge associated with construction activities	EPA	STM site	2/17/03 (permit issued by EPA 2/17/98)	Internal updates to SPPP; internal weekly site inspections
7	37232	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-1)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
8	37229	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-2)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
9	37228	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-3)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
10	37231	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-4)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
11	37230	SERI	Groundwater Monitoring Well	Permit to Construct a Well (MW-5)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	None
12	214960	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-11)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
13	214961	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-10)	Colo. Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
14	214962	NREL/DOE	Groundwater Monitoring Well	Permit to Construct a Well (MW-09)	Colo Div. Of Water Resources	STM	construction complete, permit number active until well is closed	none
15	99JE0400	NREL/DOE	Air	TCPDU air emissions	CDPHE	STM	initial approval issued 7/20/2000	None
16	20020347	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	Building 16	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually
17	20020348	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	SERF	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually
18	20020349	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	Waste Handling Facility	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually
19	20020350	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	FTLB	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
20	20020351	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	AFUF	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually
21	20020352	NREL	Hazardous Materials	Hazardous Material Storage and Use Permit for Building	West Metro Fire Protection District	Shipping & Receiving Facility	2003	Annual fee, fire dept. inspection; new chemical inventory provided annually
Notifications and Registrations								
22	PWSID Number 230860	DOE	DRINKING WATER	Non-community supply of hauled water from a surface water source	CDPHE	NWTC site	N/A	Periodic chlorine residual testing; monthly bacteriological testing; periodic lead and copper monitoring
23	CO4890000017	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	DWOP	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	annual fee to Colorado Hazardous Waste Commission
24	CO3890090076	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	STM	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	annual fee to Colorado Hazardous Waste Commission
25	COD980805162	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	JSF	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	none
26	COD983802448	DOE	HAZARDOUS WASTE	Notification of Regulated Waste Activity	CDPHE	NWTC	update recommended every 3-5 years, or sooner if substantial changes in activity occur. Last update: 7/97	none

Tracking Number	Permit or Registration Number	Permit or Reg. Holder	Permit Type	Permit Description	Issuing Agency Name	Location Description	Status/ Expiration Date	Reporting Required
27	00407-001 and 00407-002	DOE	AIR: OZONE DEPLETING SUBSTANCES	Registration of stationary appliances (2 SERF chillers)	CDPHE	SERF	annual renewal due July 1	none
28	N/A	DOE	AIR: OZONE DEPLETING SUBSTANCES	Facility Notification	CDPHE	STM, NWTC	annual notification and fee	
29	2873-001 and 2873-002	DOE	ABOVE GROUND STORAGE TANK	Registration of aboveground storage tanks	Colorado Dept. of Labor	STM--PDU Ethanol Storage Tank, SERF Emergency Generator Tank	annual registration and fee, due April/May	none
30	93000378	DOE	Historic Registration	National Register of Historic Places	National Park Service	Colorado Amphitheater	no expiration	none
31	93000379	DOE	Historic Registration	National Register of Historic Places	National Park Service	Ammunition Igloo	no expiration	none
32	AFP-CO-00255	DOE	Alcohol (not an environmental permit)	Alcohol Producer's Permit	Bureau of Alcohol, Tobacco, and Firearms	AFUF (PDU)	annual renewal due July 1	annual report due Jan 30
33	TF-CO-0331	DOE	Alcohol (not an environmental permit)	Industrial Alcohol User Permit	Bureau of Alcohol, Tobacco, and Firearms	NREL-wide	annual renewal due July 1	none
34	N/A	NREL	Transportation	Hazardous Material Transportation	U.S. Department of Transportation	NREL-wide	annual renewal and fee	none